COSTS AND BENEFITS OF MOVING FROM LOW INFLATION TO PRICE STABILITY

Malcolm Edey

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INTRODUCTION

Substantial disinflation during the past 10 to 15 years has brought inflation rates in most OECD countries from levels that were clearly too high, to levels much closer to what might generally be regarded as acceptable. By 1993, all but three of the OECD's then-Member countries had CPI inflation rates of less than 5 per cent, and 12 countries had rates less than 3 per cent. During this process of disinflation a number of countries took steps to define their inflation objectives more explicitly in numerical terms. **All** specified low positive rates, often in the vicinity of **2** per cent or less, rather than targets centred around zero. In other countries, objectives continued to be expressed in qualitative terms, which stressed the general goal of keeping inflation low without translating this into a numerical objective. In present circumstances, with inflation low but still noticeably positive, it is relevant to examine the economics of longer-run inflation objectives and, in particular, to evaluate the extent to which there is a case for aiming at zero inflation in the longer run, as opposed to being satisfied with some low positive rate. This paper provides a review of theory and empirical evidence in three areas related to this question. The first issue, covered in Section I, concerns the costs of inflation, and in particular the importance of those costs when inflation is low but positive. In Section 11, theories and evidence as to the optimal rate of inflation are discussed, abstracting from practical issues involved in the measurement of inflation. Issues of measurement, and the possible need to allow for biases in standard measures of inflation, are discussed in Section III. Finally, conclusions from these various strands are drawn together.

I. COSTS OF INFLATION

The costs of inflation are usually categorised according to whether or not inflation is fully anticipated. Costs of fully-anticipated inflation (that is, inflation to which institutional and contractual arrangements are fully adapted) arise from two sources. First, fully anticipated inflation acts as a tax on money balances and, like any tax, causes inefficient substitution away from the taxed good. In this case, economic agents are induced to lower their holdings of real balances, thus incur-

Table 1. **Empirical estimates of the costs *of* inflation**

Study	Sources of inflation cost included	Country	Income or productivity gain per 10 percentage points of inflation reduction (per cent of GDP)
Fischer (1981)	Tax on money balances	United States	0.3
Fischer (1981)	Interaction of inflation and taxation	United States	2
Lucas (1981)	Tax on money balances	United States	0.9
Cooley and Hansen (1991)	Tax on money balances and interaction with income taxation	United States	0.6
Jarrett and Selody (1982)	All	Canada	3'
Black, Macklem and Poloz (1993)	Tax on money balances	Canada	2
Black, Macklem and Poloz (1993)	Interaction of inflation and taxation	Canada	8
McTaggart (1992)	All	Australia	*2.5*
Grimes (1991)	All	OECD	0.9[1]
Englander and Gurney (1994)	All	OECD	0.6'
Fischer (19936)	All	Industrial and developing countries	0.4'

1. Per cent per annum productivity growth.

ring the "shoe-leather" costs associated with reduced transactions efficiency. Second, there are the "menu" costs associated with periodic relabelling of prices by suppliers. Available evidence suggests that neither of these costs is likely to be economically significant at low inflation rates. The shoe-leather cost can in principle be calculated using information about the money demand function, and results of some attempts to do **so** are included in Table **1**; a typical estimate for the United States economy' shows a long-run gain of 0.3 per cent in the level of GDP associated with a reduction of inflation from **10** per cent to zero. Thus it appears that these costs are only likely to be important in the case of very high rates of inflation which induce significant de-monetisation of an economy. On the second point, that of menu costs, there seems to be no serious argument that these are likely to be large.

The most important costs of inflation arise from the fact that institutional and contractual arrangements are not, in practice, fully adapted to it and, therefore, even a steady inflation has the capacity to distort a wide variety of economic transactions. The most important aspects of the costs that this generates can be grouped in four areas, discussed below.[2]

A. Interactions between inflation and taxation

Most tax systems contain important features that are not fully indexed to inflation. The non-indexation of marginal income tax scales provides one example, and results in an escalation of marginal tax rates paid by the average taxpayer as nominal earnings increase. Although this effect is usually mitigated through periodic "tax cuts", it may have the deleterious effect of encouraging a laxity of fiscal discipline by providing an easy source of revenue growth.

More important distortions probably arise in the taxation of income from capital, measurement of which can be seriously distorted under nominal accounting systems in the presence of inflation. First, the use of historical cost depreciation for tax purposes understates true depreciation costs and therefore raises the after-tax cost of capital. This effect is stronger the longer the effective life of the capital good, since the gap between historical and current cost valuations increases over time. This means that an unindexed depreciation allowance system is likely to distort both the level of investment and its composition, in favour of assets with a relatively short effective life.[3] Second, capital gains taxes in many tax systems are not fully indexed for inflation and can create quite large overstatements of taxable profits even at relatively low inflation rates. Since capital gains taxes are typically levied on realised gains, this distortion also encourages the "locking in" of asset holdings to avoid the tax, reducing the marketability of business ownership. Third, nominal tax systems mis-measure the real component of interest flows so that for a given real pre-tax interest rate, inflation reduces the after-tax real rate for both borrowers and lenders. This can have important macro-economic consequences, and low or negative after-tax borrowing costs are thought to have contributed to excessive corporate borrowing and financial insta-

bility in a number of countries during the 1980s.[4] It is conceivable that pre-tax interest rates can adjust in a way that fully offsets such effects, but empirical evidences suggests that full interest-rate adjustment to the combined effects of inflation and taxation has not typically occurred. A further consequence of this distortion is that by subsidising borrowing it may work to increase external indebtedness of high inflation countries.[6]

Estimates of the sizes of these costs vary widely although a number of researchers contend that such tax interactions are the most important of the costs imposed by inflation. Attempts to quantify them have made use of estimated investment elasticities to calculate their effects on capital accumulation and hence on potential output, and some of these estimates are included in Table 1.

B. Inflation and price uncertainty

A second mechanism by which inflation is thought to impose real costs is by generating price uncertainty. This has two aspects − the effect of high inflation on the predictability of the aggregate price level, and its effect on the variability of relative prices. These uncertainties are likely to have a number of negative effects on economic efficiency, for example by reducing the information content of the pricing system and by inhibiting long-term nominal contracting. At the level of cross-country comparisons, the first of these effects − that of high inflation on aggregate price uncertainty − appears to be well established, and is illustrated in Figure 1. Countries with high average inflation over extended periods clearly tend to be those whose inflation rates are more variable. At the individual country level, correlations between inflation and its variability are somewhat less obvious, although a number of studies have detected a statistically significant relationship.7

There are several possible reasons for this relationship, not all of which imply a causal link between inflation and uncertainty. For example, oil shocks probably explain part of the coincidence of high and variable inflation during the 1970s. Other explanations focus more on the role of the policy authorities; for example, it is argued that high inflation rates are inherently less stable because they are likely to generate pressures for policy to be changed.[8] A third possible explanation is that the Phillips curve becomes steeper at high inflation rates, making inflation more sensitive to output variations and, therefore, more difficult to control.

The potential costs of such uncertainty arise from its tendency to disrupt long-term nominal contracting arrangements. This is most likely to be important in the area of long-term debts, where, in situations of low to moderate inflation, contracts are typically not indexed (although some governments do issue small volumes of indexed securities). Aggregate price level uncertainty must increase the risk associated with non-indexed contracts and this is presumably reflected in additional risk premiums which raise the cost of capital. Whether this effect on the cost of capital is sufficiently large to affect aggregate economic performance is, however, difficult to judge. While some studies report a signficant negative correlation

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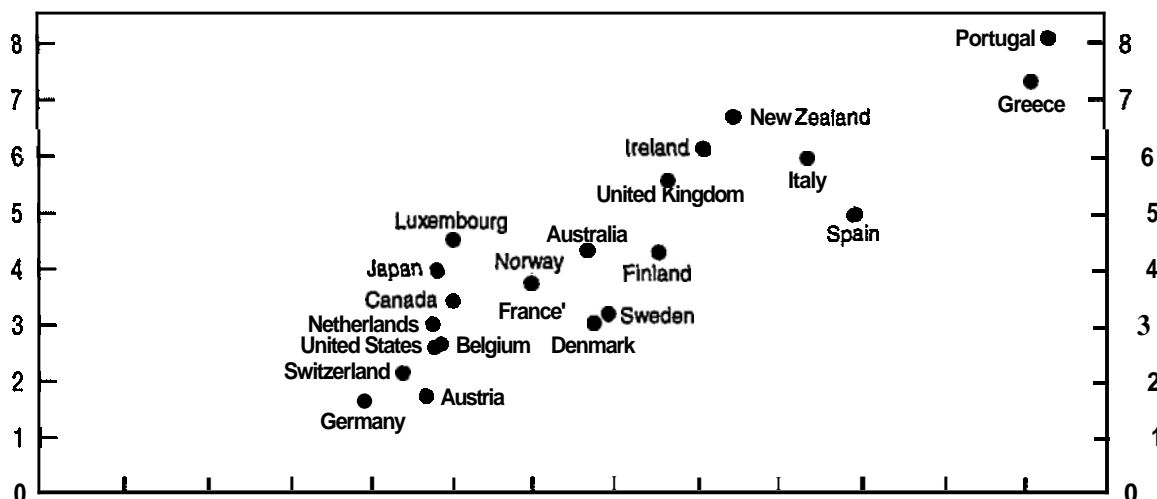
Source: OECD.

between inflation variability and economic growth, this effect does not appear to be robust in equations where the level of inflation is also included.[9]

The second aspect of price uncertainty concerns the variability of relative prices. The existence of menu costs and price rigidities means that individual price increases are unlikely to occur in coordinated fashion even under steady inflation, so that the variability of relative prices might be expected to increase with inflation. This can impose real costs because excessive relative price variability reduces the information content of prices.[10] Related to this, it is argued that inflation leads to the misinterpretation of relative price signals to the extent that agents are unable to distinguish fully between relative and absolute price changes. It is not clear, however, how strong a causal link there is between inflation and relative price variability: a clear statistical correlation exists between the two but this may be largely attributable to the influence of oil shocks, which simultaneously disperse relative prices and raise the inflation rate.[11]

C. Inflation and growth

Negative effects of inflation on capital accumulation may reduce the rate of growth of output as well as its level. Three recent studies (reported in Table 1)[12] have reported estimated reductions in productivity growth in the range of

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0.04-0.10 percentage point for each additional percentage point of inflation. While these effects may not appear large in a short-term context, they would imply important gains over the longer-term from inflation reduction, if it **is** true that the rate of productivity growth is permanently affected by inflation. There is also some evidence that the effect of inflation on growth is non-linear, and that the effect of a given percentage-point change in inflation on growth is greater when inflation is low than when it is high.

D.   Other effects

A variety of other, less easily quantified effects of inflation can be listed. These include:
- the phenomenon of "repayment tilt", whereby inflation accelerates the real repayment schedule implicit in debt contracts with constant nominal repayments;
- the resources costs involved in protecting against inflation or developing institutional and contractual arrangements *to* deal with it;
- distributional effects of inflation, including the taxation of money balances and the transfer of wealth from lenders to borrowers when inflation is not fully anticipated.

II.   THE OPTIMAL RATE OF INFLATION

The claim that inflation is costly implies that there is some optimal rate at which those costs are minimised. Conclusions as to what that rate might be, depend critically on the mechanisms by which the most important costs of inflation are generated, as well as on a number of arguments that a small amount of inflation may be beneficial for macroeconomic performance. In the simplest model where inflation is presumed to be perfectly anticipated, and no other market imperfections exist, the only cost of inflation is the efficiency loss associated with taxing money balances. Complete elimination of this cost theoretically requires the inflation rate to be negative, at a sufficient rate to reduce the level of nominal interest rates to zero, since at this level the incentive to economise on real balances is removed.[13] This argument for steady deflation has been disputed within the optimal tax framework, on the grounds that the inflation tax may have a place in an optimal second-best tax system where non-distorting taxes are unavailable. The overall practical relevance of the optimal taxation approach to this issue is also open to question, since the distortionary effects arising from the taxation of money balances appear to be relatively small compared with other costs generated by inflation. The analysis in Section I suggests that the main costs of inflation arise from the fact that it is generally less than fully anticipated.

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Inflation disrupts nominal contracting arrangements and distorts the measurement of taxable income, particularly income from capital; it therefore reduces the efficiency of the pricing system and may retard capital accumulation. These costs are eliminated at zero inflation (suitably adjusted for any measurement biases in the price index) since it is at that level that nominal accounting systems correctly measure real income and contractual obligations. This suggests a general case for zero inflation in the absence of other macroeconomic arguments for a higher rate.

Leaving aside the issue of measurement biases (discussed in Section III) the debate as to whether a higher than zero inflation rate is optimal has centred around three main issues.[14]

A. Downward rigidities in nominal wages and prices

If significant downward nominal rigidities exist, there may be a case that inflation has the beneficial effect of facilitating adjustments in relative wages and prices which are required for the efficient allocation of resources across different sectors of the economy. It has been argued, for example, that if there is resistance to nominal wage cuts, and if the monetary authorities target zero inflation, it will be difficult to achieve the reduction in relative wages that may be required in sectors adversely affected by shocks; inflation might facilitate necessary relative wage and price adjustments despite nominal rigidities and thus promote economic efficiency.

While this argument has a certain intuitive plausibility, a number of arguments have been made against it:

- Empirical evidence on the practical importance of downward nominal wage rigidities is not very conclusive. While there is clear evidence that nominal rigidities exist, the available evidence suggests that small increments to inflation do not have a significant impact on the degree of real wage flexibility.[15]
- Productivity growth already allows some scope for relative wages to adjust without inflation or nominal wage cuts (although it must be recognised that trend productivity growth is now slower than in previous low inflation periods in the 1950s and 1960s).
- In countries where there is a high degree of wage indexation or "real wage resistance", inflation may not be very effective in promoting downward *real* wage flexibility.
- The degree of downward nominal inflexibility should not necessarily be taken as given, when thinking about long-run policy issues. Such rigidities may in part result from entrenched assumptions that inflation will continue, making downward nominal adjustments seem unnecessary. Thus a sustained experience of price stability might encourage institutional developments that make nominal wages and prices more downwardly flexible. Clearly, structural policies can also have a role in promoting such flexibility in the long run.

Even if inflation does confer some benefits in facilitating relative wage and price flexibility, this clearly does not constitute a case for unlimited tolerance of inflation. As argued in Section I, inflation can itself be a distorting influence on relative price signals, particularly when it is running at high rates, and this needs to be taken into account in assessing the general case that inflation might improve the efficiency of the pricing system.

B.   A possible role for negative real interest rates

A second argument for low positive inflation is the "zero interest rate trap". Positive inflation allows scope for monetary policy to impose negative short-term real interest rates, should circumstances arise where that is considered appropriate for demand management purposes. The likely usefulness of this policy option needs to be evaluated in the light of historical experience, taking into account that other instruments such as fiscal and exchange rate policy adjustments may also be available to deal with severe contractionary shocks as they arise. Although a role for negative real interest rates cannot be ruled out, historical experiences of negative real interest rates have been relatively rare; the main example occurred in the mid-to late-1970s, a period which is usually regarded as one in which monetary policy failed to contain inflation.

C.   Credibility of low and zero inflation objectives

An important consideration in the choice of a long-run inflation objective is the inflation rate at which credibility can most readily be established. Proponents of zero inflation argue that a zero objective would provide a clear, easily communicated goal that would promote credibility, whereas any positive figure would be considered by the public to be essentially arbitrary and would cast doubt on the authorities' anti-inflation resolve. On the other hand, there may be difficulties in establishing the credibility of a zero inflation objective if it is perceived to be too ambitious and there are no strong institutional mechanisms for enforcing it. In particular, the time-consistency literature[16] argues that commitments to zero inflation are unlikely to be believed without strong institutional backing, because the authorities would be perceived not to have a strong incentive to resist small increases in the inflation rate.

To the extent that these arguments for higher-than-zero inflation have validity, a good deal of judgement is still required as to what they imply for the appropriate inflation objective." Where national authorities have set medium-term inflation goals in numerical terms, these do involve small positive rates rather than being centred around zero (Table 2), but this includes whatever allowances are made for measurement biases, and the specified ranges are close to what might be considered "practical price stability". In the United States, where numerical inflation objectives have not been set, the Federal Reserve Chairman has nonetheless described the policy objective in terms that emphasise the long-run goal of

Table 2. **Inflation objectives: selected countries'**

Percentage rates

1. Countries with formal inflation targets

United Kingdom	**1-4**	Goal is lower half of range by **1997**
Canada	**1-3**	Target range through to **1998**
Sweden	**1-3**	Target for **1995**
Finland	**2**	Target for **1995**
New Zealand	0-2	Current target range

2 Others

Germany	Maximum of 2	Medium-term inflation goal
France	Maximum of 2	Medium-term inflation goal
Italy	2	Medium-term inflation goal by **1996**
Switzerland	**0-1**	Medium-term inflation goal
Australia	**2-3**	Acceptable medium-term average

1. The price indexes that these objectives refer to are as follows:
   United Kingdom: Retail Price Index excluding mortgage interest payments;
   Canada: the CPI is the official target, but an underlying CPI excluding food, energy, and temporary effects of indirect taxes is used as an operational objective;
   Sweden: CPI;
   Finland: CPI excluding indirect taxes, subsidies and housing capital costs;
   New Zealand: CPI excluding indirect taxes;
   Germany, France and Switzerland: objectives are set out in conjunction with money growth, output and velocity assumptions, so implicitly refer to GDP deflators, although CPIs remain an important policy focus in each country:
   Italy: private consumption deflator.
   Australia: CPI is an important focus but is not explicitly the definitive measure.

price stability, defined as "price levels sufficiently stable so that expectations of change do not become major factors in key economic decisions."[18] These examples suggest a revealed preference for inflation rates that might be described as negligible, but with no special significance being accorded to the attainment of zero inflation as conventionally measured.

In public discussion the terms "zero inflation" and "price stability" are often used interchangeably, but they are not technically the same thing. A policy of price stability implies a long-run commitment to prevent the price level deviating cumulatively from a particular target level, whereas zero inflation is the less rigid commitment to aim at stable prices in each period without correcting for previous over- or under-shooting. This distinction can be generalised to the case where the desired rate of inflation is positive; policy objectives can be specified either in terms of an inflation goal for each period, or a predetermined long-run upward path for the desired price level.[19] The relative merits of these two formulations depend upon the perceived benefits of the long-run price predictability delivered by a price-level target, as against costs that might be imposed by the requirement of occasional deflation to correct any price overshooting. There is little relevant

experience on which to evaluate this question. The experience of Sweden in targeting prices during the 1930s provides one example, although the primary purpose in that episode was not to prevent inflation but to stop deflation associated with the onset of depression.[20] Simulation studies suggest (not surprisingly) that price level targets would probably reduce the variability of prices but that this is likely to have a cost in terms of reduced output stability, relative to what would be achieved under an inflation objective.[21]

The existence of transitional costs in reducing inflation raises important questions **as** to the appropriate speed and timing of inflation reduction when the rate is already relatively low and the gap between actual and desired inflation is small. Particularly relevant is the nature of the short-run trade-off involved in inflation reduction, and the extent to which the net benefits of disinflation might diminish as inflation moves down to very low rates. This involves two aspects. First, as argued in Section I, some of the costs of inflation are hard to detect at low single-digit rates, and it is possible that the marginal distortionary effects of inflation diminish in that range. Second, it is possible that short-run Phillips curves become flatter at low inflation rates, implying a rising output cost of inflation reduction when inflation is low.

The slope of the Phillips curve trade-off at low inflation is an empirical matter, and there is no conclusive empirical finding relating to the trade-offs within this range. However, if it is true that a flattening of the Phillips-curve trade-off does occur once inflation has been reduced to low single-digit rates, it suggests two important issues for policy. The first relates to the appropriate pace of further disinflation during the time period in which the shape of the trade-off itself cannot be changed by policy actions. Under such circumstances, it can be asked whether there may be a case for a relatively cautious or gradualist approach to inflation reduction, insofar as the inflation rate is already not too far above its desired range. However, the benefit of this approach — in terms of the smaller short-run loss of output and employment — has to be weighed against any damage that might be done to the authorities' credibility by being seen to tolerate inflation above the desired range for too long a period. Weaker credibility may flatten the Phillips-curve trade-off further. If hysteresis effects are important, these short-run costs of disinflation could persist for considerable periods and, in the case of full hysteresis (that is, absence of any tendency for unemployment to revert to a natural rate) there would be a permanent trade-off between inflation and unemployment. This would imply that the benefits of reducing inflation permanently have to be balanced against permanent costs. However, while this has been raised as a theoretical possibility, empirical evidence on the actual relevance of unemployment hysteresis is not very conclusive and, in any case, hysteresis itself may be influenced over the longer term by structural policies.

The second issue concerns policy actions to improve the terms of the trade-offs being faced. The slope of this trade-off will depend on structural characteristics of the economy and on the extent to which policy is successful in shifting inflation expectations during the disinflationary process. Output costs of disinflation will tend to be smaller in cases where markets are more flexible, and there

are clearly a number of areas where policy can bring about improvements in this regard; improved labour market flexibility is likely to be particularly important in many countries, and evidence suggests that the costs of disinflation tend to be lower in those countries whose labour markets are generally regarded as more flexible.[22]

Mechanisms which might help to reduce inflation expectations and enhance policy credibility have also been implemented in a number of countries. These can be thought of as helping to shift short-run Phillips curves downward, or enhancing the speed with which the position of the curve reacts to reductions in actual inflation. Such mechanisms include the announcement of inflation targets, enhancement of central bank independence, and the use of ERM membership to "import" credibility from the Bundesbank in countries where inflation has historically been higher than German rates. Experience suggests that these mechanisms take time to be effective but can yield important benefits over time. In Canada, for example, inflation expectations have clearly fallen although one indicator of credibility – the long-term yield differential *vis-à-vis* the United States – has not improved as quickly as Canada's relative inflation performance itself. In Europe a number of countries have succeeded in locking in low inflation rates as a result of their fixed exchange rate commitments and, despite recent turbulence, have experienced substantial convergence in long-term interest rates relative to Germany. These credibility gains probably had little impact on the initial short-run trade-offs faced in reducing inflation but are likely to make it easier to sustain those inflation gains in the longer term.[23]

III.   MEASUREMENT ISSUES

The reduction of inflation to rates of around 3 per cent or less has brought it into a range where ambiguities of measurement may come significantly into play. Two key issues can be raised in this area: first, which inflation rate is, in principle, the appropriate focus of policy; and second, how accurately is it measured.

A.   Which measure

Although national authorities often focus on measures of consumer price inflation, there are a number of possible alternatives to this. First, there is the choice between consumer and producer prices, trends in which can differ for a number of reasons including fluctuations in the terms of trade. The figures presented in Table 3 suggest that differences between the broadest measure of product prices (the GDP deflator) and the CPI tend to average out to relatively small numbers over time in most cases, but that divergences in individual years can be quite large (column 2 of the table), typically more than one percentage point. This could be economically significant in the context of the sort of target

Table **3.** Differences between alternative measures of inflation (1980-93)

	CPI vs GDP deflator'		CPI vs PPI[1]	
	Average difference	Average absolute difference	Average difference	Average absolute difference
United States	0.4	0.8	1.6	1.7
Japan	0.6	0.9	1.8	2.9
Germany	**-0.1**	0.9	0.8	1.3
France	0.2	0.8	1.9	3.0
Italy	-0.6	1.1	2.3	2.4
United Kingdom	0.0	1.3	1.2	1.7
Canada	1.0	**1.2**	1.8	**2.6**
Australia	0.4	1.2	0.6	1.7
Austria	-0.3	0.9	2.0	2.6
Belgium	0.4	1.5	1.8	3.6
Denmark	0.4	1.2	1.2	2.0
Finland	0.2	1.2	1.7	2.6
Greece	1.3	3.3	1.9	3.4
Ireland	1.3	2.2	2.4	3.4
Netherlands	0.4	1.2	1.5	3.4
New Zealand	0.1	2.7	1.7	3.1
Norway	1.1	2.5	1.5	2.2
Spain	0.0	1.2	2.1	3.0
Sweden	0.2	1.4	1.2	2.8
Switzerland	-0.3	1.1	2.1	2.6
Turkey	3.1	6.2	4.0	5.3

1. Inflation (CPI) minus inflation (GDP deflator or producer price ir█ x), annual rates.
Source: OECD, **Main Economic Indicators.**

ranges for inflation that are currently in operation in several countries. Discrepancies between the CPI and narrower producer price indexes that exclude services, are much larger (columns 3 and **4)**; these are typically of the order of **1** to 2 percentage points on average, and reflect the tendency for goods prices to rise more slowly than services, particularly in the tradeables sector. Since stability of a goods and services price index would imply deflation in the goods-producing industries, this phenomenon is sometimes taken as an argument for a policy focus on goods prices only.

Also important is the question of whether asset prices should be included in the measures of inflation to which policy is responsive. This issue took on a degree of practical relevance during the 1980s when increases in asset prices diverged significantly in many countries from conventionally measured inflation rates. With hindsight it has become apparent that a greater focus on asset prices as part of the inflationary process might have encouraged more timely adjustments to monetary policy in both the upward and downward direction in the late 1980s and early 1990s. \

A number of conceptual reasons have been advanced for focusing on a composite index that includes both asset and current expenditure prices. One traditional view is that policy should ideally aim at stabilising the purchasing power of money, defined as the weighted average price for all monetary transactions occurring in a given period, which includes transactions in assets.[24] A somewhat different rationale for including assets in an aggregate price index is the proposition that the true cost of living at any given point in time includes the cost of providing for one's future consumption, which involves the holding of assets representing claims on future purchasing power.[25] This concept could more accurately be described as a "cost-of-life" rather than a "cost-of-living" index, and in principle, the weight of current consumption prices in such an index would be relatively small. Both of these proposals are impossible to implement in any complete sense, since the required data on asset transactions do not exist. However some kind of weighted average of consumer prices and available asset prices could probably be constructed as a rough approximation to these indexes. It has been pointed out that some countries would have experienced deflation on such a measure in the early 1990s.

The usual conclusion reached in this kind of discussion is that there is no ideal definition of the price level, and that the appropriate definition depends on what one wants to measure. It is not valid, for example, to claim that a "cost of life" index is conceptually superior to a standard cost of living index, because this depends on whether one wants to measure the cost of current or lifetime expenditure. Similarly, there seem to be no strong *a priori* arguments for a preference between consumer or producer prices. In practice, the inflation-targeting countries have chosen to define their objectives in terms of consumer price measures, while in other countries both consumer prices and broader indexes such as the GDP deflator tend to be looked at (see Table 2).

One advantage of a policy focus on the consumer price index is that it provides an inflation measure that is well-understood and familiar to the public. This may help to promote policy credibility by making it easier for the public to monitor whether policy commitments are being met. This raises the further question as to whether it is best to focus on the raw CPI or on some adjusted index that removes volatile or temporary influences. Some adjustments that are often made in practice are the exclusion of mortgage interest costs or food and energy prices, and adjustments to exclude the temporary effects of indirect tax changes. Making these adjustments may involve trading off some of the benefit of using an index familiar to the public, in order to get a more accurate picture of underlying inflation.

B. Accuracy of the consumer price index (CPI)

There are a number of respects in which consumer price indexes do not exactly meet the requirements of a true cost of living index. These generally imply an upward bias in the measured inflation rate, and the case for allowing for such

biases in formulating inflation objectives is unlikely to be controversial, provided their size can be accurately assessed; various estimates of the sizes of such measurement biases are summarised in Table **4.** The main sources of bias are usually grouped under four headings.[26]

Table 4. Empirical estimates of bias in the CPI: United States and Canada

Study	Sources of bias included	CPI components affected	Estimate of bias (percentage points per annum)
United States			
Lebow. Roberts and Stockton (1992)	**All**	Total	1.0
Bryan and Cecchetti (1993)	**All**	Total	**Insignificant since 1981**
Gordon (1992)	**Quality**	**Consumer durables**	1.5
Manser and Macdonald (1988)	**Product substitution**	Total	**0.2**
Reinsdorf (1993)	**Outlet substitution**	**Gasoline, food**	**0.5, 2.0**
Canada			
Crawford (1993)	**All**	Total	**0.5 maximum**
Fortin (1990)	**All**	Total	**0.5-1.0**

Product substitution bias

It is generally agreed that the cost of living is in principle measured by the cost to **a** consumer of maintaining a particular level of utility. Actual price indexes are approximations to this concept, with the two most common types being the Laspeyres (base-period weighted) and Paasche (current-period weighted) indexes. Fixed-weight Laspeyres indexes, of which the CPI is an example, are particularly convenient to construct because they do not require continuous monitoring of quantities purchased or expenditure weights. However, they provide upward-biased approximations to changes in the cost of living because they do not account for the beneficial effects of product substitution; in general, when relative prices are changing, the rise in the cost of the base-period basket is greater than the increase in the consumer's cost of living, since a constant level of utility can be maintained by substituting away from goods whose relative prices have increased. Paasche indexes, on the other hand, understate cost-of-living increases through a similar mechanism working in the opposite direction.[27] However, available evidence suggests that this source of bias in consumer price indexes is likely to be relatively minor, with the most authoritative estimate suggesting a substitution bias in the case of the US CPI of just under 0.2 per cent per annum.[28]

Quality bias

Although statisticians attempt to adjust price indexes for the estimated effects of quality improvements, the measurement of quality can be subject to large errors, particularly in areas affected by the rapid introduction of new technology.[29] A recent review of this issue concludes that reasonably good methods are available for quality adjustment of computer prices, but that these are not uniformly applied across countries and there is some evidence of significant understatement of computer quality improvements, particularly in some European countries.[30] These, however, have only a small weight in the **CPI**. The same study also finds significant quality measurement biases in US consumer durables, for which annual price increases are overstated by an estimated 1.5 per cent, or a contribution of 0.3 per cent to bias in the CPI as a whole. Quality bias may also be important in the services sector, and may help to explain part of the persistent difference between goods and services sector inflation rates.

New goods bias

The introduction of new goods enhances living standards in ways that are difficult to capture in standard price indexes. The effect occurs both at the point of introduction of the new good, and in the early phase of its "product cycle", which would typically be characterised by a falling relative price and an increasing share in consumers' expenditures. To the extent that new products tend to be included in price indexes only relatively late in their product-cycles, their downward impact on the cost of living will be underestimated. Some attempts have been made to put a rough order of magnitude on this effect by identifying the share of the CPI accounted for by categories in which new goods are likely to be important, for example in consumer electronics, and applying illustrative figures for the assumed rate of price reduction of new goods in these categories. Because these categories account for only a small share of consumers' expenditure, the overall effect of new goods bias on the CPI is usually argued to be small.[31]

Outlet substitution bias

Outlet substitution bias arises through a tendency for consumers to substitute in favour of lower-cost retail outlets, so that a fixed-weighted average of prices charged by standard suppliers is likely to overstate the increase in average prices paid. This effect is likely to be most important in certain parts of the retailing sector, notably food, clothing, and household durables, where there have been long-term shifts in favour of discount stores away from smaller more specialised suppliers; these items typically account for around one-third of the weight in the CPI. An important problem in interpreting these retailing trends is that some part of an observed price discount may reflect the provision of a lower quality of service; a measurement bias arises only to the extent that there is a price differential in quality-adjusted terms. There is relatively little hard information on the likely size of outlet substitution biases, although one detailed study puts it at about 2 per cent per annum for the food component of the US CPI.[32] This is quite a large

figure although food has only a small weight in the CPI and there is little evidence as to whether other parts of the retailing sector might be similarly affected.

The evidence discussed in this section, and summarised in Table **4**, suggests that there remain a number of areas of major uncertainty as to the likely size of CPI measurement biases, and many of the estimates depend on illustrative assumptions and educated guesswork. Best guesses as to the overall size of CPI measurement biases in the United States and Canada suggest figures of up to half a percentage point in Canada and around one percentage point in the United States. It is not necessarily the case that biases in other countries are of similar magnitude, since statistical procedures such as those dealing with quality adjustment vary from country to country.

IV. CONCLUSIONS

This article is concerned with the formulation of policy objectives in circumstances where inflation has already been brought down to low single figures – the detrimental effects of inflation above that level are not in doubt. Within this context, the case for allowing some positive inflation, as conventionally measured, depends essentially on:

- the performance of economies at close to zero inflation and particularly the extent to which various nominal rigidities come into play; and
- evidence that consumer price indexes overstate inflation by economically significant amounts.

On the first of these issues, there is little conclusive empirical evidence, and ultimately an overall evaluation of them must be highly judgemental. The empirical evidence appears to support the general proposition that higher inflation is detrimental to macroeconomic performance, within the range of inflationary experiences of the OECD economies in the post-war period. However, since examples of near zero inflation in the period have been rare, this experience does not provide strong guidance as to the merits of alternative possible inflation objectives within the low single digit range. Although there are a number of theoretical arguments in support of the case that the optimal rate of inflation (appropriately adjusted for any measurement biases) might be greater than zero, there is little available empirical evidence by which to evaluate the practical importance of this case. Evidence on the importance of measurement biases, largely based on data for the United States and Canada, suggests a tendency for consumer price indexes to overstate inflation on average. These biases do not appear to be large, but may be significant in relation to current levels of inflation in many OECD countries, and in relation to plausible candidates for medium-term inflation objectives.

NOTES

1. Fischer **(1981).**

2. For a more detailed review, see Selody **(1990).**

3. These effects are analysed by Ryan **(1991).** The asset life effect diminishes for assets with extremely long effective lives because depreciation becomes a less important component of the cost of capital for such investments.

4. See for example OECD **(1992).**

5. For example, Carmichael and Stebbing, **1983.**

6. This link is modelled by Black, Macklem and Poloz **(1993)** and Gruen **(1991).**

7. See, for example, Ball and Cecchetti **(1990),** Evans **(1991).**

8. This is the argument made by Friedman **(1977)** in his Nobel lecture.

9. This conclusion is reached by Fischer **(1993b).**

10. Ball and Romer **(1993)** calculate that these costs can be economically significant at moderate inflation rates.

11. Strong evidence for this interpretation is presented by Bomberger and Makinen **(1993).**

12. See Grimes (1991), Fischer **(1993b)** and Englander and Gurney **(1994).** Further evidence of a negative effect of inflation on productivity growth is provided by Rudebusch and Wilcox **(1994).**

13. This theoretical result was established by Friedman **(1969)** and subsequent literature is reviewed by Woodford **(1990).**

14. These points are discussed by Summers **(1991)** in support of the case that the optimal inflation rate is positive. This case is disputed by proponents of zero inflation, for example Crow **(1988),** Freedman **(1991).**

15. Ball and Mankiw **(1994)** outline the general case that nominal rigidities are important determinants of macroeconomic outcomes. Evidence on the effects of inflation on relative wage flexibility is presented by Crawford and Dupasquier **(1993)** and Lebow, Stockton and Wascher **(1993),** with largely negative results.

16. See for example, Kydland and Prescott **(1981).**

17. For example, Summers **(1991)** suggests that these factors might justify a long-run goal of **2** to **3** per cent inflation; Fischer (1993a) nominates a range of **1** to **3** per cent.

18. Testimony to the House Committee on Banking, Finance and Urban Affairs, January **24, 1989.**

19. This distinction is analogous to that in monetary targeting between targets with and without base drift.

20. The Swedish authorities specified a target for the level of the CPI after leaving the gold standard in 1931. This experience is reviewed in detail by Jonung (1992).

21. See Lebow, Roberts and Stockton (1992) and Fillion and Tetlow (1993).

22. For these purposes, labour market flexibility could be defined as the responsiveness of real wages to changes in demand conditions. Estimates reported in OECD (1989, p. 44) suggest that flexibility in this sense is significantly greater in Japan and, to a lesser extent, the United States, than in Europe.

23. For a discussion of this experience, see Egebo and Englander (1992).

24. This was Irving Fisher's view, and is discussed in more detail in the review article by Wynne and Sigalla (1993).

25. This view was originally put forward by Alchian and Klein (1973) and has recently been endorsed by Goodhart (1993). It argues that when asset prices rise, the nominal cost of buying real resources to provide for one's future (e.g. a house, or the real assets represented by a corporate equity) rises, and hence so does the "cost of life" price index.

26. For recent reviews, see Crawford (1993), Wynne and Sigalla (1993), Lebow, Roberts and Stockton (1992), Fortin (1990) and Gordon (1993). Some of these studies point out that sources of downward bias also exist, although it is agreed that the overall net bias is likely to be upward.

27. It is not strictly the case that the "true" index must always lie between the Laspeyres and Paasche values, since they are approximations evaluated at different levels of utility (base period and current-period, respectively). This property requires that preferences or price changes from one period to the next are sufficiently smooth. See Hill (1988).

28. Manser and Mcdonald (1988). It is possible that this bias is smaller in some other countries due to a more frequent updating of CPI expenditure weights than in the United States.

29. Quality measurement errors are usually argued to work in the direction of a net understatement of quality improvement. However, there is some evidence of biases in the other direction in some categories of goods, for example clothing.

30. Gordon (1993).

31. Crawford (1993) suggests a maximum figure of 0.1 per cent for the Canadian CPI, while Lebow, Roberts and Stockton (1992) estimate a maximum bias of 0.5 per cent for the United States.

32. Reinsdorf (1993).

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